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Chemical & Engineering NEWS

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Letters

Earth's changing temperature

SIR: Your article in C&EN, Oct. 26, page 7, entitled "Warming trend tied to atmospheric CO_2" leads the reader to conclude that there is scientific evidence that the average temperature of Earth is increasing. Just the reverse is true, in the northern hemisphere at least, as the data in your article itself suggest. You state that during the fall and winter the temperatures between 55° and 80° north latitude "were about 5 °C lower than in the 1930's."

Analysis of current trends has led a number of scientists to speculate that a new "mini" ice age may be in the offing. This cooling trend, which began about 1940, has had severe effects in the Arctic. According to Soviet researchers, the ice-covered area between Greenland and the eastern tip of the Soviet Union has, on an average, increased 600,000 sq km during the summer season. The mean annual air temperature over the Kara Sea has fallen 3 °C. The result of increased sea ice has generally shortened the summer season on the Soviet Union's Arctic coast by almost a month.

Whereas the northern hemisphere appears to be definitely in a cooling phase, the southern hemisphere appears to be warming up for reasons nobody understands. If these climate changes were associated with society's activities and the buildup of CO_2, one might expect the northern hemisphere to be warming up rather than the southern hemisphere since the northern hemisphere is more heavily industrialized. The fact is that Earth has undergone cyclic temperature changes entirely independent of humanity's activities for thousands of years of recorded history, and evidence indicates that these processes have gone on for many millions of years. The reasons for these changes are not at all understood, and there is no evidence that it can be tied to any of society's activities.

Ponca City, Okla. James C. Kirk

Generating method not new

SIR: In the Oct. 26 issue of C&EN, page 17, a method for generating methane based upon reaction of graphite with water vapor or alkali hydroxides was reported by Gabor Somorjai and Alejandro Cabrera of Lawrence Berkeley Laboratory.

The method described is not new. Reaction of water vapor or alkali hydroxides with graphite at 250 °C to form methane is typical of some carbides. The formation of aluminum and beryllium carbides along with their hydrolysis to methane was reported as early as 1897.

According to available literature, a temperature of 1200 °C is required to initiate the carbon aluminum reaction to form aluminum carbide. These compounds are pyrophoric and sublime at approximately 2000 °C.

The high temperature (3000 to 3500 °C) required to manufacture graphite from coal or coke provides a reaction atmosphere for formation of carbides. Graphite is the condensate from the heat treatment of coal or coke. This heat treatment provides ample opportunity for formation of aluminum carbide with aluminum in coal ash at 1200 °C, sublimation of aluminum carbide at 2000 °C, and coatings of the carbide with heavy condensate to prevent spontaneous ignition.

Ten years ago, a colleague and I submitted a proposal to the U.S. Bureau of Mines concerning reaction of coal and fly ash at high temperature to produce methane during hydrolysis of the aluminum carbide formed. Our proposal did not include the possibility of a salable product.

My congratulations to the researchers. I think their work demonstrates originality and this will be required to solve energy problems in America.

Morgantown, W.Va. Kenneth B. McCaskill

Doughty/Freeman reaction

SIR: In a recent issue of C&EN (July 13, page 4) B. W. Giesemann reports, as "another violent reaction," the reaction of trichloroacetic acid and copper wool in DMSO. We wish to call attention to the fact that this reaction is analogous to the reaction described by H. V. Doughty and B. Freeman [*JACS*, **43**, 703 (1921)] as a convenient means to dissolve a copper deposit from a silver cathode. The Doughty and Freeman reagent consisted of a 10% solution of trichloroacetic acid in aqueous ammonia (one part concentrated ammonia and one part water).

We have repeated the Doughty and Freeman reaction, adding copper wool to the reagent mixture. The copper dissolved smoothly, the solution taking on the color of the cupric ammine complex. According to Doughty and Freeman, in this reaction three atoms of Cu require two molecules of trichloroacetic acid. We have also tested the reaction of copper with trichloroacetic acid dissolved in a solvent (a) composed of equal volumes of DMSO and H_2O and in solvent (b) compound of equal volumes of acetonitrile and H_2O. With both of these solvents a reaction takes place. With solvent (a) the resultant solution was initially green in color while in the case of solution (b) the solution was colorless.

As a final experiment we repeated the Giesemann reaction, adding copper wool to the solution of the trichloroacid in DMSO. Although the bottom of the Pyrex erlenmeyer where the wool rested became definitely hot, the reaction proceeded quietly. The resultant solution was strongly yellow in color.

We acknowledge the valuable assistance of Star Glad with these experiments.

Thomas G. Dunne
Arthur F. Scott

Reed College, Portland, Ore.

Correction

• Nov. 30, page 30: The University of Minnesota Institute of Technology is not among the schools that have raised their tuition this year to increase engineering faculty salaries.

Chemical capital spending will stay weak

After holding down global capital expenditures to a 1% gain in 1981, major U.S. chemical companies plan a 6% increase in 1982

William F. Fallwell
C&EN, New York

A few heads must be shaking in Washington, D.C. After giving U.S. chemical and other industries a Whitman's Sampler-sized box of tax sweeteners to encourage job-creating investment, the government is being greeted with very modest gains in capital spending plans for 1982.

It isn't quite so illogical as it looks, however. Companies have universally praised the new incentives from Washington but are waiting until two things happen to take advantage of them. The economy has to start growing again, and companies' large excess plant capacity has to dry up.

Since both of these developments look somewhat distant at this mid-recessionary moment, companies are keeping a decidedly light hand on the spending button. C&EN's annual survey of 17 leading basic chemical companies finds that, on average, they plan just a 6% increase in worldwide outlays for new plant and equipment in 1982 from 1981. These plans follow a tiny 1% spending increase in 1981 from 1980, much less than the 8% gain originally budgeted (C&EN, Dec. 8, 1980, page 19).

Both of these annual increases fall considerably short of inflation. This means that, in reality, capital spending in the chemical industry has shrunk two years in a row after the last major gain, a 23% increase in 1980.

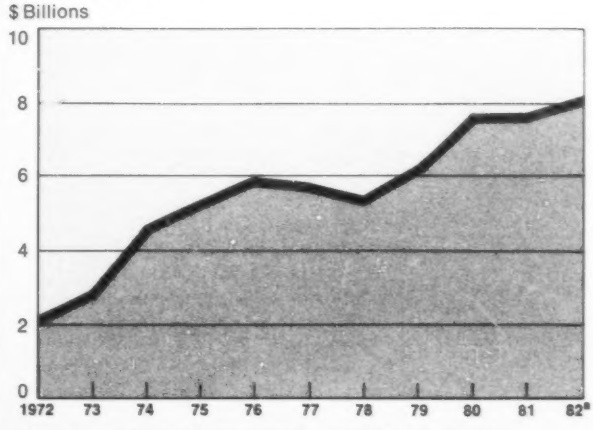
Even with such restraint, basic chemicals and polymers in the U.S. are swimming in extra plant capacity. Completion of projects started in balmier times several years ago has pushed up overall plant capacity in basic chemicals faster than the rise in production in 1981. In C&EN's latest capacity use survey (C&EN, Oct. 12, page 12), plant use in basic chemicals in the third quarter ran a disappointing 72% of the nameplate maximum, down from a none-too-good 74% in the first quarter.

So, despite hopes in the past few years that modest capital spending would combine with normal product growth to yield high capacity-use rates in the early 1980's, plants in many products are running at even lower rates than in the recessionary mid-1970's. The main reason is that product growth has been nonexistent for most basic chemicals since 1979. Although industry analysts fully expected slower product growth in the 1980's, no one expected a complete halt for three years.

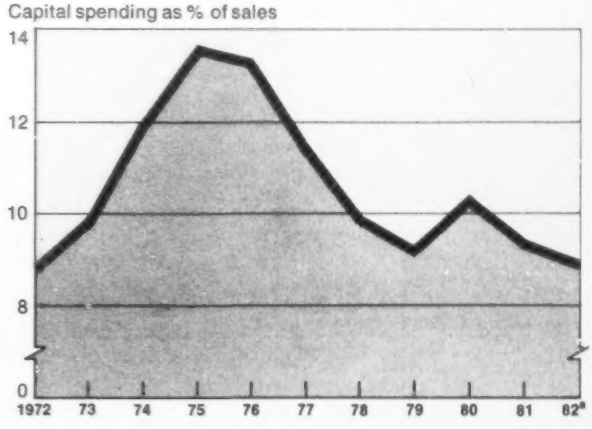
The slack in capital spending comes even clearer in the ratio of spending to industry sales. Over the past three decades, this ratio has ranged from about 8% in slow years to 5% in red-hot spending booms. Right now, the ratio is diving toward the bottom of the range. It dropped to 9.5% this year from 10.4% in 1980 and is heading for 9.0% in 1982. If the 1982 estimate is accurate, next year will be the lowest since 8.9% in 1972, the weakest capital spending year of the past decade.

Within the spending totals, several interesting internal shifts are under way. One is immediately apparent from the company data. Despite widespread predictions of a fresh boost in capital spending outside the U.S. this decade, just the opposite has occurred for most companies in 1981 and 1982. The result is that, for the first time in recent years, capital funds tagged for projects in the U.S. make up more than 80% of the total worldwide budgets for chemical companies. For 1982, U.S.-bound money will be 81% of the total, following 80% in 1981. The old rule of thumb was about 75% of capital funds for U.S. projects.

Chemical capital spending will increase only slightly in 1982...



...and will remain notably low as a percentage of chemical sales



a C&EN estimate. **Source:** Combined data from major chemical companies

1981 capital spending is 7% less than first budgeted

$ Millions	1982 Worldwide	1982 U.S.	1981 Worldwide	1981 U.S.	Worldwide 1981 Planned[a]	Worldwide 1980	Worldwide 1979	Worldwide 1978	Worldwide 1977	Change from previous year 1982	Change from previous year 1981
Air Products	$ 400	$ 340	$ 323	$ 275	$ 390	$ 364	$ 246	$ 200	$ 143	24%	−11%
Akzona	68	68	60	60	60	64	54	42	35	13	−6
Allied Corp.	700	550[b]	600	470	675[b]	533	409	502	465	17	13
American Cyanamid	185	150	185	150	205	196	235	251	235	0	−6
Celanese	400	280[b]	390	275	350	253	245	248	243	3	54
Diamond Shamrock	540	524	537	520	450	381	257	319	390	1	41
Dow Chemical	1000	650	1100	715	1400	1184	1268	1075	1163	−9	−7
Du Pont[c]	1400	1200	1300	1100	1300	1279	864	714	704	8	2
Ethyl Corp.	120	100	120	100	130	156	123	96	88	0	−23
W. R. Grace	800	711	686	613	650	657	511	309	279	17	4
Hercules	180	160	160	143	220	229	186	116	127	13	−30
Monsanto	660	575	600	525	800	781	566	480	607	10	−23
Olin	160[b]	150[b]	160	150	170[b]	172	161	163	208	0	−7
Pennwalt	95	90	50	43	70	56	67	62	46	90	−11
Rohm & Haas	na	na	150	120	150	93	68	66	79	na	61
Stauffer Chemical	215	204	255	246	200	246	239	201	193	−16	4
Union Carbide	1300	910	1200	800	1150	1129	831	688	805	8	6
TOTAL FOR 16 FIRMS[d]	**$8223**	**$6662**	**$7727**	**$6185**	**$8220**	**$7680**	**$6262**	**$5436**	**$5731**		
ANNUAL CHANGE	**6%**	**8%**	**1%**	**6%**	**7%**	**23%**	**15%**	**−5%**	**−3%**		

a Earliest estimate. b C&EN estimate. c Excludes Conoco. d Excludes Rohm & Haas. na = not available.

West German spending in the U.S. to fall

Capital spending in the U.S. by the three largest West German firms will drop sharply in 1982, according to their current plans. This is a reversal of 1981, when capital spending in the U.S. by American Hoechst, BASF North America, and Mobay and other Bayer subsidiaries rose from previous-year levels.

Planned capital expenditures by these companies in 1982 will total about $473 million, a 14% decrease from 1981 expenditures.

However, one company—American Hoechst, the U.S. arm of Hoechst A.G.—is increasing its spending. American Hoechst will boost spending to about $118 million, about 18% above the company's spending for plant and equipment in the U.S. this year.

BASF and the U.S. subsidiaries of Bayer will hold their spending at 1981 levels next year. BASF North America includes BASF Wyandotte and Badische Corp.

The U.S. subsidiaries of Bayer present the worst case for 1982 of the three major West German firms. Spending at Bayer's U.S. subsidiaries—Mobay, Miles Laboratories, and Cutter Laboratories—will drop 27% in 1982 to about $155 million from $248 million spent on capital equipment in 1981. This year, Mobay and the other Bayer subsidiaries were the only ones in the group to increase capital spending—up 21% from 1980 levels. The decrease at Mobay and the other Bayer subsidiaries next year comes because they are ending a three-year investment cycle.

For the past few years, the rate of spending by the West German firms generally had been been increasing, although the average annual rate of change was slowing.

William Storck, New York

U.S. subsidiary (parent)	Capital spending in U.S. ($ millions) 1982[a]	1981	1980	1979	1978	Change 1981–82	Average annual change 1978–81
American Hoechst (Hoechst)	$118	$100	$100	$189	$105	18%	−2%
BASF North American (BASF)	200	200	200	136	118	0	19
Mobay and other subsidiaries (Bayer)	155	248	220	150	119	−27	9

a C&EN estimate.

Home-country spending is outpacing worldwide totals for U.S. chemical companies in both 1981 and 1982. Domestic spending is still up 6% in 1981, whereas the worldwide gain is just 1%. This means, of course, that non-U.S. spending has fallen hard in 1981, 17% from 1980. For 1982, companies plan just a 1% increase in spending outside the U.S.

A good example of the international funding switch is Monsanto. A year ago, the company still estimated that 25% of its 1981 spending would go outside the U.S. Now the company estimates its non-U.S. budget at 13% of the total after making major cuts in both U.S. and non-U.S. segments.

An exception is Celanese, which is bearing out the old prediction of large increases in money for new foreign plants, especially over natural gas fields. In both 1981 and 1982, Celanese estimates that about 30% of its capital spending will be outside the U.S., compared to 23% in 1980. The company has major new projects in Canada, Mexico, Brazil, and Saudi Arabia. Celanese's overall capital budget also is bucking the tide with a 54% increase in 1981 to a level sustained for 1982.

Besides the geographic reshuffling of capital funding, another internal shift may be in the offing. Dow Chemical suggests that an important

reason for its reduced capital budget in 1981 and 1982 is a change in priorities for investment. Dow is lowering somewhat the emphasis on capital-intensive basic chemical plants worldwide and increasing the emphasis on less capital-intensive downstream specialties. This shift naturally follows the company's decision to make specialties (formally called "end products and services") half its total profits in 1990 compared to just 20% in 1978 (C&EN, Nov. 23, page 10).

As a result, Dow no longer leads the pack in chemical investment after greatly exceeding other companies' spending through the late 1970's. From a high point of $1.3 billion in 1979, Dow steadily has reduced its spending to $1.2 billion in 1980, $1.1 billion in 1981, and $1.0 billion estimated for 1982.

In both 1981 and 1982, Dow will come in third for the 17 companies in C&EN's survey behind Du Pont and Union Carbide. Both Du Pont (excluding Conoco) and Union Carbide have made major increases in capital funds since 1978. Du Pont has lifted its capital budget from $714 million that year to $1.4 billion estimated for 1982. Carbide has picked up its spending from $688 million in 1978 to an estimated $1.3 billion in 1982.

Although Du Pont and Carbide have stuck close to planned spending targets in 1981, the industry as a whole has not. Downward economic pressures have brought about a 7% shortfall from original plans for the combined 17 companies. Nine of the group actually cut spending from 1980, although only three had planned to do so.

Such performance in 1981 puts a caution into industry's estimates for spending in 1982. Again, just two companies (Dow and Stauffer Chemical) say they will reduce spending from 1981. But capital spending plans have a way of tilting toward the direction of the business cycle even though companies try to plan for conditions two to three years away.

For engineering companies and equipment suppliers, the relaxed state of chemical plant funding is not good news for 1982. But the truth is, although the chemical industry has the money to spend, it doesn't see the need for at least another year. □

PPG turns mine into waste disposal site

PPG Industries plans to convert its worked-out limestone mine at Norton, Ohio, to a storage facility for chemical wastes. A Pittsburgh-based consulting firm has termed the site, near Akron, "ideal." And, at a planned rate of 50,000 tons per year of waste to be stored, it is large enough to give the company nearly 200 years of storage capacity. PPG expects about 20% of the waste to come from company plants around the country, and the rest to come fron non-PPG plants handled on a contract basis.

The company, which is putting together its application to submit to the Environmental Protection Agency for licensing under the provisions of the Resource Conservation & Recovery Act, will not handle nuclear or radioactive wastes. Nor does it plan to handle wastes with a high vapor pressure—for example, gasoline and paint thinner. That will virtually exclude, PPG says, materials labeled flammable.

Worked-out Norton limestone mine will provide huge amount of storage space

According to Robert E. Widing, vice president of PPG's agricultural and performance chemicals division, the site "is no ordinary mine." The cavern is a series of roughly four-story-high rooms, carved out of rock nearly one half mile underground. The mine is dry, avoiding potential rust problems, and there are no connections to the surface except for personnel and production shafts. Those conditions, and the presence of a 1500-foot cap of shale overhead, led D'Appolonia Consulting Engineers to conclude that the site "not only was uniquely suited for chemical waste storage but also would provide the highest degree of protection for the environment and public health that such a facility could have." The mine "is simply too deep" to contaminate surface water, points out Phillip Antommaria, an engineer with D'Appolonia.

Under PPG's plans, the company will build a special access road to the site, and build a closed, all-weather unloading station. Containerized materials to be disposed of will be stored in the rooms making up the 300 million cu ft of mine dug out while it was being worked, from 1942 to 1976, for soda-ash raw materials. After each room is filled, it will be sealed with a concrete or cinder-block wall.

The idea of using worked-out mines for storing chemical wastes is not new, but it is new to the U.S. West Germany's Kali & Salz, for example, uses its old mines for disposal. However, PPG hopes to avoid the storm of controversy that erupted when Kali agreed three years ago to store arsenic wastes and Kepone for Allied Chemical (C&EN, July 31, 1978, page 7).

Instead, PPG is emphasizing community relations. Before it made any announcements to the press, company officials met with the mayor and other leading citizens of Norton to inform them of the plan and ask their help and cooperation. For example, the mayor was requested to appoint an advisory committee that will have a chance to review the information the company uses in its permit applications. And it informed its employee-union representatives, company employees, and regulatory-agency officials of the plan before its press conference earlier this month. "We wanted to do this in an intelligent and sensitive way," a PPG staffer says, to answer local community concerns. □